Tokyo Workshop for a Future Internet

May 16, 2010
9:00-17:00
Keio University, Tokyo, Japan

Izumi AIZU Tama University
Mito AKIYOSHI Senshu University
Nao FUKUSHIMA Mitsubishi Research Institute
Noriko IGARI NTT/GLOCOM
Akito INOUE GLOCOM
Toshiya JITSUZUMI Kyushu University
Keisuke KAMIMURA GLOCOM
Masanori KUSUNOKI Microsoft
Akinori MAEMURA JPNIC
Jun MURAI Keio University
Nobuhisa NISHIGATA Ministry of Internal Affairs and Communications
Akimichi OGAWA Blogger
Hajime ONIKI Institute of Economic and Information Research
Akiko ORITA Keio University
Kenji SAGA JICA
Masahiko SHOJI GLOCOM
Shigeki SUZUKI Ministry of Internal Affairs and Communications
Yoshihiro TAGAWA Institute of Information Security
Motohiro TSUCHIYA Keio University
Tomoaki WATANABE GLOCOM
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>0900-1000</td>
<td>Welcome and overview of project followed by keynote speech of Jun Murai</td>
</tr>
<tr>
<td>1000-1030</td>
<td>In pairs/threes: key elements in four scenarios (goal 1)</td>
</tr>
<tr>
<td>1030-1100</td>
<td>Whole-group discussion</td>
</tr>
<tr>
<td>1100-1115</td>
<td>Coffee break</td>
</tr>
<tr>
<td>1115-1200</td>
<td>In three groups: isolating the key social, economic, technical scenario</td>
</tr>
<tr>
<td></td>
<td>trends and their inter-relationship (goal 2)</td>
</tr>
<tr>
<td>1200-1300</td>
<td>Lunch</td>
</tr>
<tr>
<td>1300-1400</td>
<td>Groups report back: Plenary discussion</td>
</tr>
<tr>
<td>1400-1530</td>
<td>In three groups: identifying Internet-focused R&amp;D and policy actions</td>
</tr>
<tr>
<td></td>
<td>that promote positive trends (goal 3)</td>
</tr>
<tr>
<td>1530-1545</td>
<td>Coffee break</td>
</tr>
<tr>
<td>1545-1700</td>
<td>Groups report back: Plenary discussion</td>
</tr>
</tbody>
</table>
Jun Murai, professor of Keio University, made a keynote speech at the beginning of the workshop. He stressed that dialogues between Europe and Japan would contribute to the establishment of truly global Internet. The current network topology of the Internet is U.S.-centric (Chart 1). Networks from Asia cross the Pacific Ocean to reach the United States, and European traffics cross the Atlantic Ocean to reach the American east coast. However, direct bandwidth between Europe and Asia is quite thin. Current network traffic from Tokyo must go through South East Asia and Middle East to reach Europe. Traffic on the route is slow and expensive compared to the networks via the U.S. It might be a good time to lay down submarine optic cables under the Arctic Ocean when global warming melts ice.

Chart 1: Global Network Traffic
Source: http://neoreading.files.wordpress.com/2010/01/traffic_map08_large.jpg
When we look at data of weekly traffic on the Internet, we realize that the traffic is increasing especially in the evening. Our life is becoming dependent more on the Internet than on television. Television advertisement revenues are going down, while Internet advertisement revenues are overtaking newspaper’s. Devices accessing the Internet are extremely varied. For example, Play Station has a very wide grid computing network. It is wider and more robust than anything else. Key will be next generation television. Now more television sets have a RJ45 connection for Ethernet and an HTML 5 browser to enable 3D broadcasting data. These next generation TV sets change the Internet.

The missions of POTS (Plain Old Telephone System) and broadcasting have to be redefined by the Internet. NGN (Next Generation Network) and mobile LTE (Long Term Evolution) are not future Internets. LTE is a telephone by a telephone operator. While RBOCs (telephone operators) and cable companies (television broadcaster) are competing for Internet access in the United States, Japanese optic fiber is different from the past technologies (Chart 2). New competitions will emerge soon.

![Chart 2: Number of Broadband Subscribers in Japan](image)

**Source:** Ministry of Internal Affairs and Communications

Language diversity is also a critical issue to discuss. Upper layers in the Internet technologies are becoming more important. The number of Chinese Internet users went beyond 400 million in March 2010, and it is expected to grow more. The volume of
Chinese content will follow the number of the users. However, English, or American, is still dominant in the share of content. On the other hand, minority languages, which don’t have enough users and convenient methods to use on computers, are facing the risk of extermination. Language diversity and cultural diversity is closely connected. And knowledge is based on languages. Europe has 27 member states and 23 official languages. European experiences must play an important role to make the Internet richer.

Another problem is fragmentation of the Internet. Interception, blocking and filtering are more common these days even in democratic countries such as Australia. There are 13 root domain name servers (DNS) in the world. China is claiming that it is a majority user and is qualified to have one. In a technical sense, China has many root servers using anycast technologies. The real problem is whether China should have an operating function of a root DNS. When Jon Postel first decided where to locate 13 root servers, he picked places where blocking or filtering doesn’t occur. Is there any institution who guarantees the free flow of traffic in China?

Spectrum allocation plays another important role for a future Internet. When we introduced RFID (Radio Frequency Identification) worldwide, we definitely needed the 950 MHz band. Because it is a commercially profitable slot, many operators wanted to take it. However, we wanted the slot available globally. Then, we met colleagues from China and South Korea to discuss to establish a common standard and China agreed with us to make the band available.

The Internet is an infrastructure for global democracy. It enabled dialogues among different cultures and states. Japan and Europe should lead the standardization process for better technologies. Most of us are influenced by the size of the Chinese market. Even ITU (International Telecommunications Union) is adjusting its standards to China. Market size has a strong power over others. But we need to create markets of truly good nature. Without them, we cannot proceed. Technological standards should be market-driven. However, China is largely influencing the world market. Should Internet governance change? How can we respond to new environments? We have said that the private sector must lead the Internet and the government sector must support the private sector. The assumptions for that are changing rapidly. Can we stick to the traditional principles of Internet governance? This is the most important agenda that Europe, the U.S. and Japan should address.
Goal 1

Compare the different scenarios, in terms of their social and economic impact: which elements from each are the most desirable for a more sustainable (or otherwise better) world?

Which of the four scenarios is the most hopeful? Obviously the Commercial Big Brother is not. It is not appropriate for a single commercial company or organization to control content, applications and infrastructures. However, if a market system works properly, we don’t need to worry about the rise of a hegemonic service provider. No hegemon can stay in its position forever, because a next powerful actor would challenge the hegemony and takes it over. In the past we were afraid of the excessive controlling power of Microsoft, but the company is being challenged by Google, Amazon, Apple and others. A challenger might show up from unexpected places. Google challenged Microsoft not in operating software, but in networking technologies. We can expect the rise of new technologies and ideas in the future after Google. It is most important not to control or regulate new movements. Governmental support might not help in truly new areas. It has been very rare for a government to find and help innovative movements, which could destroy established interests. Network effects sometimes pick up only one winner. The winner creates monopoly without cartels. Transition of phases would solve the negative sides of monopoly.

When Eastern European countries moved from communism to democracy, television was a key technology. The current Internet topology is U.S.-centric. All of the big brother-type actors are from the U.S. However, Europe is also a major player in the ecosystem of ICT. Does Europe want to be the next hegemon? Is it seeking another way? It is often said that Japan is like the Galapagos Isles: it is evolving in its own way without communicating with the rest of the world. Now other countries are emulating Japanese business models. There is room for other ideas to survive.

It can be also said that the four scenarios are not independent nor be in parallel, but be sequential. As the Internet is a basic infrastructure presupposing other activities, it must evolve in a smooth way. When we have several options to develop it, we need to pick up the cheapest and greenest option. That process includes how to solve digital divides.
When infrastructure is constructed, services on it have network effects or network externalities that often have monopolistic results. One of such service providers becomes dominant. If it threatens democracy, opposition powers rise and e-democracy wins. In that sense, e-democracy needs a big brother before birth. Without big brother’s oppression, grass roots activists won’t emerge. Europe and Japan should consider the way to deal with China. When China started to establish the Cyber Great Wall, many people ridiculed the idea. Now many authoritarian regimes are emulating it. If we have to work together with China, we should not excessively stick to our own values and should not be dragged about by Chinese values.

Even if the four scenarios were not sequential, each of the four scenarios would appear in the process of Internet evolution. Developments of devices would take us to the knowledge economy. When ICTs were able to save our time and energy, we could go green. If the market gets mature, natural monopoly would emerge in networks and a big brother would take lead. And the masses would be happy to have opium. Services and content, which are provided by a big brother, would be convenient and fun for most of us. They must be happy to give privacy if they get more convenient, comfortable and enjoyable opium. They would not mind what they give and take. This process is an inevitable market principle, which is difficult to stop. In the future it might happen that Baidu, a Chinese search engine, buys out Google. The big brother scenario is not ideal at all. To avoid this, at least we must ensure competitors can enter markets. Monopoly could eventually narrow our options and extinguish future possibilities.

However, some notes should be taken on entertainment and gaming. The commercial big brother scenario regards entertainment as “mass opium” with a negative sense. The Japanese game industry is somehow different from European and American ones. Gaming is a type of information architecture to be used for positive purposes too.

It would be possible to assume that going green is somehow automatic, because knowledge-based societies don’t need physical transportation for communication and exchange of information, and because environmental problems such as global warming force us to move forward. However, we have to make the best use of our limited energies. Especially the wider use of cloud computing needs more servers running 24 hours 365 days each year. Air conditioning of server rooms is against going green. Renewable energy must be generated on sites where electric demands arise. And if we really go green, we have to be aware of the energy costs of digital communications.
An aging workforce is a serious problem not only in Europe but also in other parts of the world. Even China will face a rapidly aging society after 2030. The Chinese population will rise above 1.4 billion around 2030, but will decrease after 2030 due to the current one-child policy. ICTs should be utilized to solve this common agenda.

Chart 3: Population Estimate of Countries
Source: http://esa.un.org/

Closing digital divides might be possible in Europe. But other parts of the world will face more serious divides. China and India will catch up, though Sub Saharan Africa and the Pacific Islands are less hopeful. The latter countries need several or more decades to catch up with advanced economies.

Is it possible for the e-democracy and the knowledge economy scenarios to co-exist in a society? Collective intelligence works well in the e-democracy, but it cannot be applicable to every aspect in social systems. Market principles tend to produce gaps between the rich and poor. The e-democracy scenario is ideal, and autonomous people can cooperate for each others’ sake. However, they might lose interest and depend on a few influential persons, or need greater efforts to reach an agreement. Furthermore, the Internet might move people in radical directions. Such costs and risks should be considered in power transition. Does e-democracy have more legitimacy than the existing representative systems? We have to anticipate a lot of confusion in the
transition process. Even so, we should not be too pessimistic. The confusions will create a better world eventually.

Goal 2

| How will current technological, social and economic trends lead to the different scenarios proposed? What is the impact of different architectural choices (NGN, clean-slate approaches, non-IP, end-to-end principle, openness, embedded security) in enabling the different scenarios? |

The key phrases discussed were “opium of the masses,” “carnival world” and “runaway justice.” Some phenomena on the Internet come to gain greater power and influence in undesirable ways. Such trends stir up excessive controls over the Internet. In addition, technologies complicate those issues.

Infrastructures have not evolved since around 2005. Device vendors are increasingly fixed. This is not caused by governmental interventions, but controls among private sectors are taking control of upper layers. New devices enable DPI (deep packet inspection), blocking and other traffic controls. Some ask why we don’t censor and control when we can easily get such technologies. Japan was slower to introduce these devices, because NTT, the largest telecom operator, has been prohibited by law to enter upper layers. Discussion was started in around 2000 by Lawrence Lessig’s CODE. Especially the wider diffusion of computer viruses changed the situation. However, we have not yet had enough deep discussion of human nature behind malicious software. Some people are fighting for freedom, but others are seeking control. Social divides are becoming wider. And we should not mix blocking of political speeches and blocking of child porn.

e-democracy is rising. However, floods of mass anger sometimes go to BBSs, blogs, and social networking sites. In the past such movements were simple. Now people tend to think who are really influential in social problems. For example, when they watch problematic content on a TV program, their target is not a broadcaster, but commercial sponsors of the program. Wider sharing of the knowledge of social systems changes political movements. Most of participants in such movements believe from the heart that they are doing right things. Even if information, which is used for such movements, is wrong or misleading, it is strengthened and becomes common knowledge with link
after link. A Japanese TV entertainer was attacked online based on falsified rumor that he had killed someone. Many people were persuaded by made-up stories and believed the rumor. They made numerous phone calls to police and his agency. Some of truly nasty distributors of the rumor were arrested by police, but most of them believed they were doing something good. Online communications might get rid of psychological barriers. On the contrary, mass media’s quality is going down and fewer people trust it these days. Business models of mass media are losing their edge.

However, we are still wondering if the Internet can take over the roles of mass media. More and more people participate in network activities and use such technologies. As they have come to gain very cheap technologies and services advancing rapidly, they are accustomed not to pay for them. Cheap revolutions disrupt business models. As Chris Anderson’s *FREE* discussed, newer business models are becoming subtle and tricky. Even if you don’t have to pay now, you are forced to pay later in other ways or somebody else is paying for you in exchange for your privacy.

The relationship between technology and society is interactive. Our daily lives and work are more and more dependent on networks. And networks sometimes change us in good or bad ways. We swing between radicals and radicals. Discussions on networks require us to respond instantaneously and accelerate the speed of communication. Architectures to offset such effects are needed to stabilize our democracy.

There are various types of collective wisdom. One type is to collect and share knowledge like open source software. Second is to forecast the average among collected data, as James Surowiecki discussed in *The Wisdom of Crowds*. He quoted an example of the collective guess of the weight of a cow in a fair. Third is a reputation system, though this works well enough for positive reputations but not for negative reputations, because actors who get bad reputations simply change their names. Fourth is through selective processes of markets as legal policy studies distinguish “authoritative decisions” and “market decisions.” The latter is a distributed decision-making defined by individual market selections. As the Lehman Brothers shock in 2008 showed, market decisions sometimes have unacceptable results and need authoritative decisions (or regulations). Note that democracy usually gives one person one vote, though market gives a rich person more votes.

When we think of product reviews, simple rating doesn’t work well enough. The
Internet often generates radical rating and it is sometimes not fair, then the simple average of ratings does not represent real evaluation. As Daniel Kahneman & Amos Tversky’s paper, "On the Psychology of Prediction," revealed, people tended to be influenced by default evaluations. For example, many people tend to use default settings of personal computers. Or, people tend to click the first hit of online searches. Perceptions are more fragile than we think. To avoid such brutal ratings, minority evaluations are picked up by intention these days. And there are several other architectures to make evaluation fairer and collective intelligence more effective.

What kinds of architectures should we build in terms of infrastructures and services? When we assume IP exists in the meantime, the question of whether IPv4 or IPv6 doesn’t matter much because we have to go through co-existing periods at least until 2020. We cannot expect a disruptive technology over IP. Overlay problems during transition will be serious to switch to a new technology. But it does not justify that we don’t have to think of possibilities for better technologies.

Wired optical networks or mobile wireless connection? These technologies will also co-exist and take each role for mutual complement, but the role of mobile technologies will be greater. How about the third generation LEO (low Earth orbit)? Europe will implement it by 2020. However, geostationary orbit satellites have greater time delays, not enough for very high-speed Internet.

Services and applications change quickly. Will 3D technology have meaningful developments for individuals, families and businesses? The technology will be used for other purposes beyond television. Although Japanese game users prefer downloading, American and European consumers seem to prefer interactive games, which might generate demands for 3D. However, it could be risky to pick up one technology over others, because it narrows other possibilities and makes small-sized companies less competitive.

YouTube, Twitter, Ustream and Nico Nico Douga (http://www.nicovideo.jp/) are not easily monetisable, but they are innovative enough to change network traffic. They were not funded by governmental R&D budgets. Innovative and advanced technologies will change how people interact and think. And the emergence of new technologies is defined by local social trends and contexts. Some services might get popular in one society, but not in another.
Of course, prices matter in deployment of new technologies. When we say technological developments, there are new innovative services to reconstruct existing architectures and sustainable services to make existing architectures cheaper and more effective.

For the time being, we cannot assume the rise of radical innovations, which discontinue current services. Various continuous technologies will change them step by step. We keep the Internet neutral for new technologies, and the adoption of them will be decided by demands and costs. Although markets will grow, social and political elements influence a future Internet and the Internet might differ region by region on the earth. The American approach to keep the Internet free might not be accepted by some countries, which have different languages, traditions, religions and customs.

Digital divides are always a concern when we talk about new technologies. New expensive technologies are not easily adopted in developing regions and they are not adopted by older or poorer segments in a society. Such divides are continuously seen between advanced users and followers. If so, is a policy to make such technologies and services universal with taxpayers’ money justified? Japan is trying to deploy optic fiber broadband all over the islands to replace copper lines. Is it really necessary? We should not disregard the cost-benefit analysis in every geographical region. It would be better to deploy wireless technologies than fixed optic fibers in African countries. We have to define new standards for universal service.

We need to think of psychological and perceptonal aspects of new technologies in our society. Gaming and social networking are technologies to lower our psychological hurdles. We should be aware of penetrating technologies.

On one hand, users sometimes overestimate risks and get afraid of new technologies and systems. On the other hand, they underestimate risks when they are very convenient. For example, shopping advantages change the way people give away private information. They disclose location information while they hide names. There are gaps between perceptions and behaviors, and the gaps create security holes. Consumer minds are fragile.

It is often said that human psychology doesn’t change, but online communication sometimes changes it. There are problems on unconscious levels and problems of
preconscious mental activity. Individual personal history, digital literacy and other things change our behaviors online. A Japanese novel, *Koizora*, which was written by an unheralded author using a mobile phone, is symbolic. Older generations cannot accept it as a novel. A younger generation, which uses a mobile phone on a daily basis and transmits a lot of messages with it every day, finds reality in the novel. Literacy and habits change our perceptions. Among the four social, psychological, technological and economic factors, psychological or perception factor plays a bigger role. It decides which of the four scenarios comes up. And as Lawrence Lessig argued in *CODE*, changes in architecture could influence governance. Another point Lessig made in the article “Against Transparency”\(^1\) is that excessive disclosure generates groundless rumours. He stressed that no architecture is neutral. Is the IP protocol politically and technologically neutral? We can alter architecture, but should we keep it outside political interests? In that sense, a political factor should be added to the four factors. Politics in cyberspace are influenced by real world politics such as virtual battles between the U.S. and China.

Network neutrality is highly politicized in the U.S. But there is no consensus what network neutrality is. Technological neutrality is discussed whether the FCC favors a specific technology. Are there any common features among those neutralities? Technological neutrality means that it doesn’t care which technology is a winner and that no governmental intervention is expected in it. Network neutrality is discussing connectivity and content delivery requiring somebody (often governments) to ensure equal opportunities for all participants. Apple’s iTunes Store is picking up applications. When Apple was a minor player, nobody cared. But now Apple’s products and services have wider impacts.

**Goal 3**

How will policy options (e.g. network neutrality) impact on the emergence of the different scenarios? What should be the future priorities for ICT research in Internet architectures and infrastructures?

Below is a list of R&D items to be prioritised (random order):

- network security

\(^{1}\) http://www.tnr.com/article/books-and-arts/against-transparency
- protection of minors online
- cheap access devices
- development of learning/education technology to eliminate both of geographical and generational digital divides
- online manner or ethic book for information literacy
- market liberalization and regulation
- abolishment of barriers to entry
- spectrum allocation
- rights of way
- open platform and interoperability
- automatic translation with deeper understanding of cultural backgrounds
- sensor and tracking technology, privacy protection and anonymous method
- open government
- multi-language platform
- digital rights management

Only people who can’t speak English well understand the importance of multi-language adoption. EU has 27 member states and uses 23 languages. EU should take the lead in this area. The establishment of a Lingua franca is not always a solution for multi-cultural systems. Having 23 languages is an advantage of Europe. The diversity made it possible to develop GSMs for transnational mobile communications and it became a world standard eventually. Overcoming multi-cultural boundaries is a European competitive edge.

European countries have lived with neighbors of different cultures. This situation always needs diversified human-centric approaches. They are always seeking ways to solve problems. Japan is isolated and technology-oriented. We have better infrastructures and technologies, but we are not always making the best use of them. We had better learn from European human-centered policies/regulations such as ID, privacy and data protection.

Infrastructures are the basis of an information society. We can send a message from anyone to anyone globally. But in order to understand how can we design and control such a vast communication, we should research people’s behaviors in information environments.
If we highly rate the e-democracy scenario and follow it, R&D for its implementation, experiments and policies are keys. Conventional democracy gives one person one vote, but we can modify it: for example younger generation gets more votes because they are more responsible for present and future social designs. These kinds of ideas are widely discussed, but serious implementation and experiments are rare. A mature information society must be open to these challenges.

Mark Granovetter stressed the strength of weak ties. We should not cut those ties in societies. Aging societies find more lonely elders who have very few or no ties. Younger generations who cannot find fixed jobs also lose connections with others, and that situation lowers possibilities to find jobs. Systems to connect weak ties are necessary in highly fluent societies. Social networking sites could contribute to better management of those ties.

Japan, the U.S. and Europe are using the same services such as YouTube, Facebook and others, but how to use them is different country to country. Global services are not necessarily used in the same way. It implies that global ethics for our future information society cannot be easily established. Even so, we should have efforts on how to manage privacy in transnational communications. As data collection methods become more subtle and hidden, management of those technologies is a new policy task. Each piece of data is tiny, but aggregated data reveal something new and meaningful.

We should bring more information out of boxes. That is a necessary condition of collective intelligence and e-democracy. Without enough information available, we cannot make wise choices and decisions. Especially governments should open up their data with special care to security and privacy. Large volume of data needs technologies for search and analysis. With these data and technologies available, true e-democracy starts to work.

We are facing floods of information. We don’t know where necessary information is and we cannot look at all of available information. We can use others’ evaluations, but they are sometimes distorted or biased. This problem of the growing quantity of data has been and will be biggest among all the problems.

It is also true that we don’t know real value of information until we consume it. In addition, there are no economic incentives to tell others how valuable the information
was and how it was used. Therefore, personal experiences are not socially utilized. That’s why information on the Internet is the mix of gravel and diamonds. Too much gravel hinders our productivity. A solution to distinguish diamonds from gravel beyond Google’s algorithms would be a truly valuable innovation.

We have not discussed well enough how to manage content businesses. Micro online payment methods are not widely used in Japan. A big future task is to collect a fee for content and distribute it fairly among concerned parties. Contributors must get paid according to their contributions, though too much tracking of content usage could be harmful for business itself.

Generational digital divides are as important as geographical digital divides. Many of the younger generation in Japan are accustomed too much to mobile use. They sometimes lack in PC skills. This problem is not easy to eliminate. While we go forward to an advanced information society, even the young could be left out.

Conclusion

First, defining the scope of governmental and private sector roles is a necessary step to design a future Internet. When we talk about Internet policies, we can limit them in simple deployment of infrastructures as universal service with network neutrality regulation over them. However, idyllic landscapes of the past Internet, which was developed by the limited number of geeks who share norms and philosophies, are not acceptable anymore. Governmental interventions are not avoidable for Internet governance among 1.4 billion users and more devices. Security and safety, especially protection of minors, is the core of the governance. The U.S. tends to seek market approaches among service providers, but Europe and Japan seek wider governmental roles.

Second, time scale of the policies is an issue. Industrial policies aim to maximize public welfare. Then, do we look at the long-term future or five-year achievements? Are stimulus policies in ICT R&D necessary to overcome an economic crisis? We had better have clear policy targets in near-term and long-term.

Third, ensuring diversity is critical. Chinese rise in the Internet is influential, and elimination of digital divides will change the demography in cyberspace. In order to
continue innovations and to avoid risks, the world must be diverse and have multiple poles. Japan is labeled as mono-culture society, but we are open to new ideas and eager to adopt new technologies. Japan can be a test bed for advanced systems. Europe is diverse and is succeeding the tradition of the Roman Empire, which was open to new ideas. Diversity and multilingualism must not be equal to fragmentation.